

## **Enforcing constraints for interpolation and extrapolation in Generative Adversarial Networks**

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Generative Adversarial Networks (GANs) are becoming popular machine learning choices for training generators. At the same time there is a concerted effort in the machine learning community to expand the range of tasks in which learning can be applied as well as to utilize methods from other disciplines to accelerate learning. With this in mind, we suggest ways to enforce given constraints in the output of a GAN generator both for interpolation and extrapolation (prediction). For the case of dynamical systems, given a time series, we wish to train GAN generators that can be used to predict trajectories starting from a given initial condition. The incorporation of the constraints respects the primary game-theoretic setup of a GAN so it can be combined with existing algorithms. Also, there are connections between enforcing constraints and the construction of reduced-order models. We provide examples of linear and nonlinear systems of differential equations to illustrate the various constructions.